Appl. No. 10/070,616
Response dated February 5, 2004
Reply to Office Action of January 9, 2004

Amendment to the Claims:

The list of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1 (original): A plastic optical fiber having a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of a core) - 35]°C.

2 (original): The plastic optical fiber as claimed in claim 1, wherein the core comprises a homopolymer of methyl methacrylate, or a copolymer comprising a methyl methacrylate unit and another monomer unit.

3 (original): The plastic optical fiber as claimed in claim 1, wherein the core comprises a homopolymer of methyl methacrylate and has a birefringence absolute value of not larger than 2.0×10^{-4}.

4 (original): A plastic optical fiber which has a core comprising a homopolymer of methyl methacrylate and having a birefringence absolute value of not smaller than 1.5×10^{-4} and has a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of the core) - 20]°C.

5 (original): The plastic optical fiber as claimed in any one of claims 1 to 4, which exhibits a shrinkage ratio of not higher than 2% when heated at 90°C for 65 hours.

6 (original): The plastic optical fiber as claimed in claim 4, which exhibits a shrinkage ratio of not higher than 0.5% when heated at 90°C for 65 hours.

7 (currently amended): A plastic optical fiber cable obtained by forming a coating layer around the plastic optical fiber as claimed in any one of claims 1 to ~~[[6]]~~ <u>4</u>.

8 (currently amended): A plastic optical fiber cable that has a protective layer comprising a vinylidene fluoride-tetrafluoroethylene copolymer formed around the plastic optical fiber as claimed in any one of claims 1 to [[6]] 4 having a core-sheath structure in which the sheath comprises a polymer containing a fluorine-based methacrylate unit or a vinylidene fluoride unit and that has a coating layer comprising Nylon 12 formed on the protective layer.

9 (currently amended): A plugged plastic optical fiber cable obtained by attaching a plug on the tip of the plastic optical fiber cable as claimed in claim 7 [[or 8]].

10 (currently amended): A production method of a plastic optical fiber, comprising the step of annealing a plastic optical fiber obtained by heat-drawing an undrawn fiber obtained by melt spinning, at a circumferential velocity ratio between the front and rear rollers (circumferential velocity of a rear roller / circumferential velocity of a front roller) of 0.5 to 1.2 under heating conditions which satisfy $4 \leq y \leq -1.5x + 330$ and $(Tgc - 5)°C \leq x \leq (Tgc + 110)°C$ wherein Tgc represents a glass transition temperature of a core, x represents an annealing temperature (°C), and y[[:]] represents an annealing time (seconds).

11 (original): The production method as claimed in claim 10, wherein a homopolymer of methyl methacrylate, or a copolymer comprising a methyl methacrylate unit and another monomer unit is used as the core.

12 (currently amended): The production method as claimed in claim 10, wherein the core of the plastic optical fiber comprises a homopolymer of methyl methacrylate, the heat drawing is carried out such that the birefringence absolute value of the core becomes 3×10^{-4} or higher, and the annealing is carried out at a circumferential velocity ratio between the front and rear rollers (circumferential velocity of the rear roller / circumferential velocity of the front roller) of not higher than 1 under conditions which satisfy $x \leq (Tgc + 20)°C$, wherein [[(]]Tgc[[:]] represents the glass transition temperature of the core, and x[[:]] represents an annealing temperature (°C)[[)]].

13 (original): The production method as claimed in claim 10, 11 or 12, which has the step of carrying out annealing under the heating conditions twice or more.

14 (original): A production method of a plastic optical fiber, comprising the step of annealing a plastic optical fiber obtained by the method as claimed in any one of claims 10 to 13 at a temperature not higher than [(a glass transition temperature of a core) + 8]°C.

15 (original): A plastic optical fiber obtained by the method as claimed in any one of claims 10 to 14 and having a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of a core) - 35]°C.

16 (original): The plastic optical fiber as claimed in claim 15, wherein the core comprises a homopolymer of methyl methacrylate and has a birefringence absolute value of not larger than 2.0×10^{-4}.

17 (original): A plastic optical fiber obtained by the method as claimed in any one of claims 10 to 14, having a core which comprises a homopolymer of methyl methacrylate and has a birefringence absolute value of not smaller than 1.5×10^{-4}, and having a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of the core) - 20]°C.

18 (original): The plastic optical fiber as claimed in claim 15, 16 or 17, which exhibits a shrinkage ratio of not higher than 2% when heated at 90°C for 65 hours.

19 (original): A plastic optical fiber cable obtained by forming a coating layer around the plastic optical fiber as claimed in any one of claims 15 to 18.

20 (original): A plugged plastic optical fiber cable obtained by attaching a plug on the tip of the plastic optical fiber cable as claimed in claim 19.

21 (previously presented): A production method of a plastic optical fiber, comprising the step of annealing a plastic optical fiber obtained by heat-drawing an undrawn fiber obtained by melt spinning, at a circumferential velocity ratio between (circumferential velocity of a rear roller / circumferential velocity of a front roller) between the front and rear rollers of 0.5 to 1.2 under heat conditions which satisfy $4 \leq y \leq -1.5x + 330$ and (Tgc - 5)°C $\leq x \leq$ (Tgc + 110)°C, wherein Tgc represents a glass transition temperature of a core, x represents an annealing temperature (°C), and y represents an annealing time (seconds), while a tension of 0.35×10^6 to 1.5×10^6 Pa is applied to the fiber.

22 (original): A production method of a plastic optical fiber, comprising the step of annealing a plastic optical fiber obtained by melt spinning, at a temperature from (a glass transition temperature of a core – 5)°C to (the glass transition temperature of the core + 80)°C while a tension of 0.35×10^6 to 1.5×10^6 Pa is applied to the fiber.

23 (original): The production method as claimed in claim 22, which has the step of heat-drawing a plastic optical fiber and carrying out the annealing after heat-drawing the plastic optical fiber.

24 (original): The production method as claimed in claim 21, 22 or 23, wherein a polymer containing a methyl methacrylate unit in an amount of not smaller than 70% by weight is used as the core of a plastic optical fiber.

25 (original): The production method as claimed in claim 22 or 23, wherein a homopolymer of methyl methacrylate is used as the core of a plastic optical fiber and the annealing is carried out at a temperature not higher than (a glass transition temperature of the core + 30)°C such that the core has a birefringence absolute value of not smaller than 1.5×10^{-4} and the plastic optical fiber has a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(the glass transition temperature of the core) - 20]°C.

26 (original): The production method as claimed in any one of claims 21 to 25, wherein the annealing is carried out by introducing a plastic optical fiber into an annealing zone substantially vertically to a horizontal plane.

27 (original): The production method as claimed in any one of claims 21 to 25, wherein the annealing is carried out by use of a heating furnace disposed substantially horizontally with a plastic optical fiber to be annealed supported by a heating medium which provides buoyancy to the plastic optical fiber so as to cause the plastic optical fiber to travel within an annealing zone in a non-contact manner.

28 (original): The production method as claimed in any one of claims 21 to 27, wherein the annealing is carried out by alleviation treatment.

29 (original): The production method as claimed in any one of claims 21 to 28, wherein the annealing is hot air annealing.

30 (original): The production method as claimed in any one of claims 21 to 29, wherein the annealing is carried out such that a produced plastic optical fiber exhibits a shrinkage ratio when heated at 90°C for 65 hours of not higher than 0.5%.

31 (original): A production method of a plastic optical fiber cable, comprising the steps of obtaining a plastic optical fiber by the method as claimed in any one of claims 21 to 30, and then forming a coating layer around the obtained optical fiber.

32 (original): A production method of a plugged plastic optical fiber cable, comprising the steps of obtaining a plastic optical fiber cable by the method as claimed in claim 31, and then attaching a plug on the tip of the obtained optical fiber cable.

33 (new): A plastic optical fiber cable obtained by forming a coating layer around the plastic optical fiber as claimed in claim 5.

34 (new): A plugged plastic optical fiber cable obtained by attaching a plug on the tip of the plastic optical fiber cable as claimed in claim 8.